



Frequency distribution of bone metastases secondary to prostate cancer: A retrospective study in Khartoum oncology hospital 2020

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Abstract

Purpose: Prostate cancer is common cancer in men in the world, Bone metastases and skeletal-related events are major causes of morbidity. This study reveals the incidence of bone metastases and the most frequent sites secondary to prostate cancer in Khartoum oncology hospital.

Method: A Retrospective study in Khartoum oncology hospital September 2019 to March 2020. Demographic and clinical information extracted from the medical records of eligible patients in the last 5 years 2015-2019 included age, sex, social habits, duration of prostate cancer, duration of treatment, and location of bone metastasis. Statistical analyses were performed using SPSS, Version 22.0.

Results: From all patients diagnosed with prostate cancer, 12.25% had developed bone metastasis out 52.4% of whom of patients developed bone metastasis in 2-5 years of diagnosis of prostate cancer and 40% in less than 2 years of diagnosis. lumbar vertebrae (56.9%) is the most common site of bone metastasis followed by pelvis (50.5%), Lumbar vertebrae L4 and L5 tended to be more commonly affected (35.8%, 34% respectively).

Skeletal-related events in 70 patients (63.3%), involved bone fracture in 1.8%, bone pain in 58.56%, hypercalcemia in 9%, and other spinal cord compression manifestation in 25.2%.

Conclusions: The most common site of bone metastasis in prostate cancer is lumbar vertebrae, the duration of prostate cancer affects the development of bone metastasis, exploring the knowledge of patient populations prone to develop bone metastasis and skeletal-related events helps in further intervention and management.

Keywords: bone metastasis; distribution pattern; prostate cancer; lumbar vertebra; skeletal related events

Introduction: Background

According to a projection of the World Health Organization, cancer is considered as the second cause of death in developing countries (10.4%) [1]. In Africa, about 681,000 new cases and 512,400 deaths were reported in 2008 [2]. Thus, cancer poses a tremendous burden for the health system, as well as the entire economy, throughout Africa because of both treatment costs and drop-out of the working power of patients [3].

Prostate cancer is the sixth most common cancer in the world [4], and the most common cancer in men [4, 5, 6, 7]. The skeleton is the most common organ to be affected by metastatic cancer [8] with the prevalence highest in breast and prostate cancer [9]. Prostate cancer progresses to the stage of bone metastasis very quickly; 85–100% of patients who die from prostate cancer have been found to have bone metastasis [10].

Previous studies have shown that: advanced prostate cancer is accompanied by skeletal metastasis [6, 7], and the Distribution pattern according to its frequent site are located mainly in the spine and pelvis followed by ribs [6, 7, 10, 11, 12].

The prevalence of cancer cases has dramatically increased in Sudan in recent years and cancer is ranked as the major cause of death. The majority of patients attend at an advanced stage of the disease [13] With BM which can be painful and can cause other problems, such as fractures, spinal cord compression, or high blood calcium levels, which can be dangerous or even life-threatening and can impact the quality of life for these patient and result in poor prognosis. Therefore knowing the distribution pattern and the most common site of bone metastasis can contribute to early detection of a metastatic lesion and hence decrease the incidence of the skeletal complication.

During our study, we found that previous data on metastatic bone disease in patients with prostate cancer were limited especially regarding the contribution of PC site and duration to several distant bone metastases and in particular the specific vertebral segments' involvement. This review aimed to determine the size of patients population with BM from PC, to identify and analyzes specifically the most potential sites for BM, to find out the time of diagnosis of BM after PC, the PC site-specific risk to develop

BM and the contribution of PC duration to several distant bone metastases.

Methods

A health facility-based Retrospective record review was conducted in Khartoum oncology hospital, Khartoum, Sudan from September 2019 to March 2020.

We designed a Structured Data-sheet that includes: patient's demographic information, duration of primary malignancy, treatment method for primary malignancy, Duration of treatment, site of bone metastasis, skeletal-related event. Clinical datasets were collected from the medical records of 906 patients with Prostate cancer at Khartoum hospital for Oncology between January 2015 and September 31, 2019. During these 5 years, a total of 111 Patients (12.25 %) who had been initially diagnosed with prostate cancer and then later developed the metastatic bone disease were included.

We explained the purpose of the study and ensure the confidentiality of the information to the participant, and verbal informed consent was taken from them after taking the ethical approval from the ethics committee of the Sudan Ministry of health and Khartoum oncology hospital.

After that, we started to screen the medical record of cancer cases retrospectively for 5 years ago from 2015 to 2019. We included prostate cancer cases with bone metastasis in our study, we depend on the result of the bone scan to detect the bone metastasis.

The exclusion criteria were as follows: a patient record of other types of cancer, prostate cancer without bone metastasis, record without Demographic information, or with missing data especially Bone scan result.

For statistical analysis, the following parameter: age, sex, social habit, site of primary malignancy, and duration of treatment were analyzed for validity as prognostic factors. Statistical significance was defined as $P < 0.05$. analysis were performed using SPSS, version 22.0 (IBM, USA).

Results

Baseline character, a medical record database method was used in Khartoum Oncology Hospital to identify 906 patients with prostatic cancer between 2015 and 2019, 12.25% (111 patients) had secondary bone metastases. The mean age of patients with metastatic cancer was 71 years. 52.4% of these patients were diagnosed with BM in less than 2 years, 40% were diagnosed between 2 to 5 years, and 7.6% in more than 5 years. (Table1)

Bone metastases sites, Significant correlations ($P=0.006$) between the period of diagnosis and number of bone metastases at a distance was established.

Spinal vertebrae (74.8%) and pelvis (50.5%) are the most common sites of bone metastasis secondary to prostatic cancer. Spinal vertebrae subdivided to its four components, cervical, thoracic, lumbar and sacral and each one shows different metastatic prevalence than others, spinal metastases found in 83 patients (74.8%), 62 patients of them (74.7%) have lumbar metastases, 46 patients (55.4%), 28 patients (33.7%), 22 patients (26.5%) have thoracic, sacral, cervical metastases respectively (Figure1).

In general lumbar vertebrae (56.9%) is the most common site of bone metastases secondary to prostatic cancer followed by pelvis

(50.5%), thoracic vertebrae (42.2%), ribs (39.4%), femur (32.1%), clavicle (27.5%), sternum (27.5%), sacral vertebrae (25.7%), skull (24.8%), cervical vertebrae (20.2%), humerus (16.5%) and tibia (6.4%) as in (Table2).

Lumbar vertebrae L4 and L5 tended to be more commonly affected (35.8%, 34% respectively) than other lumbar vertebrae L1, L2, and L3 (17%, 26.4%, and 30.2% respectively) as shown in (Table4).

Skeletal related complications and events, Skeletal complications in 70 (63.3%) patients, involved bone fracture in 1.8% (2 patients), bones pain in 58.56% (65 patients), hypercalcemia in 9% (10 patients), other spinal cord compression manifestation like back pain, numbness in lower limbs, decrease power in lower limbs and loss of sphincter control in 25.2%(28 patients), 12.6%(14 patients), 14.4%(16 patients) and 6.3%(7 patients) respectively as in (Table3) and (Figure2).

Table 1: shows the baseline characters of prostate cancer, their mean of age and durations of disease.

Characteristics	Values
Total patients with cancer	906
Patients with metastasis	111 (12.25%)
mean of age	71 years
Duration of disease	
<2 years	(52.4%)
2-5 years	(40%)
>5 years	(7.6%)
Percentages from total of 111 cases with bone metastases	

Table 2: shows the common bone site affected by prostatic cancer, table shows lumbar vertebrae are the common sites for metastases followed by pelvis

Common bony sites	percentages
Lumbar vertebrae	62(56.9%)
pelvis	55(50.5%)
thoracic vertebrae	46(42.2%)
ribs	43(39.4%)
femur	35(32.1%)
clavicle	30(27.5%)
sternum	30(27.5%)
sacral vertebrae	28(25.7%)
skull	27(24.8%)
cervical vertebrae	22(20.2%)
humerus	18(16.5%)
tibia	7(6.4%)
Percentages from total of 111 cases with bone metastases	

Table 3: shows common skeletal events related to prostate cancer, pain considered to be the commonest event and mainly affect the back

Common skeletal events	percentages
All events	70 (63.3%)
Bone pain	65 (58.56%)
Bone fracture	2 (1.8%)
Hypercalcaemia	10 (9%)
Spinal cord compression	
back pain	28 (25.2%)
numbness in lower limbs	14 (12.6%)
decrease power in lower limbs	16 (14.4%)
loss of sphincter control	7 (6.3%)
Percentages from total of 111 cases with bone metastases	

Table 4: shows: the common vertebral site affected by prostatic cancer, Lumbar vertebrae are affected more frequently than other vertebral bones, especially L4 and L5.

Vertebral sites	percentages
C2	1(1.9%)
C4	3(5.7%)
C5	4(7.5%)
C6	4(7.5%)
C7	12(22.6%)
T1	2(3.8%)
T2	5(9.4%)
T3	4(7.5%)
T4	2(3.8%)
T5	7(13.2%)
T6	5(9.4%)
T7	7(13.2%)
T8	9(17%)
T9	10(18.9%)
T10	8(15.1%)
T11	6(11.3%)
T12	8(15.1%)
L1	9(17%)
L2	14(26.4%)
L3	16(30.2%)
L4	19(35.8%)
L5	18(34%)
Percentages from total 111 cases with bone metastases	

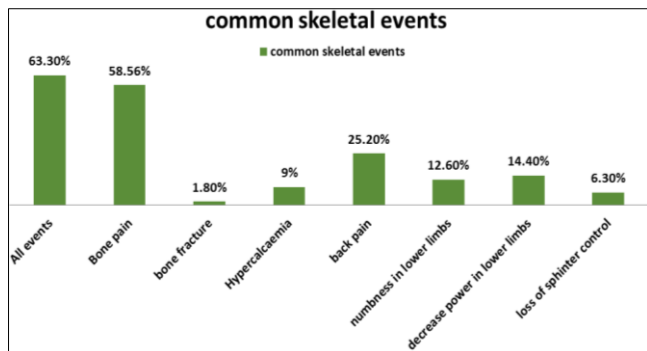


Fig 1: shows common skeletal events related to prostate cancer, usually more than two-third of prostate cancer having these events, pain considered to be the commonest event and half of them have back pain.

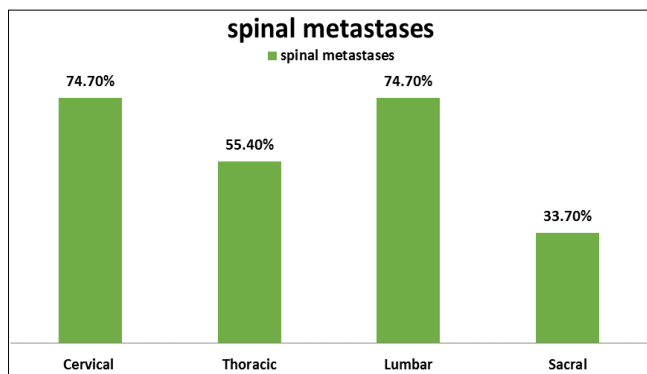


Fig 2: is comparing between parts of spinal vertebrae metastases in patients with prostatic cancer. Parentages here are from 83 patients (74.8%) having spinal metastases.

Discussion

Prostatic cancer is the second most prevalent cancer in the world in men after lung cancer, typically asymptomatic, signs frequently arise after spreading to remote areas that occurs late in the natural history of cancer, However, due to this late identification of cancer clinically, majority of patients present with complications and skeletal events and usually patients don't expect to live for five years.

One of the big aims of this study is to demonstrate the exact pattern of bony metastases in patients with prostatic cancer and to explore in details frequencies of these sites in Sudanese population, globally a tremendous articles studied bone metastases in prostate cancer, in 2008 a cohort study in the USA emphasized that from 6427 patients who identified with BM (29%)1862 patients had prostate cancers as primary tumor type [14], bone metastases were found in 84%, 40.6% and 34.2% of patients with prostatic cancer in Canada, Iran, and China respectively [16, 17, 15], in our study prevalence of bone metastases in prostatic patients is 12.25%, these difference in prevalence may base on different genes and environmental factors and need further study.

Our result and other articles [17, 19] have shown that spinal vertebrae and pelvis are the most commonly affected bones, in Switzerland, at 2000 they studied spinal sites and found commonest sites are lumbar followed by thoracic and cervical vertebrae [18], however, in our study lumbar shows more frequent metastases than other spinal vertebrae followed by thoracic, sacral then cervical vertebrae. Thus lumbar vertebrae are the most common part of bone affected by prostatic metastases either in comparison with all bone or with spinal bones. This typical pattern of distributions can provide a tendency to grow with orderliness to a certain degree throughout the entire body [10].

In this retrospective study, approximately two-thirds of patients experienced skeletal-related complications, a lot of patients in advance stages of prostate cancer (up to 80%of patients) [20] experiences bone pain, which consider the commonest complications, a similar study conducted in united kingdom stated that 40% of patients of prostate cancer with bone metastases had skeletal-related complications like bone pain, fractures, and cord compression and concluded that bone pain and lower urinary tract complications are the commonest complications in the final year of life in men dying of advanced prostate cancer [21].

All of the previous complications occur due to osteoblastic metastases which increased osteoblastic cell activity leading to abnormal bone formations which can cause pressure on surrounding organs to cause pain, that easy bone to be fractured, and increased calcium level in blood. Moreover, the expansion of tumors in the bony vertebra can compress the spinal cord lead to numbness and weakness of lower muscle and sphincters.

Single database nature is one of the limitations, but this limitation could consider as a strong point because Khartoum Oncology Hospital is one of two oncology centers in all Sudan that supported by Sudan government and offer free treatment sessions for those suffering from cancers, the other center is approximately 300KM away from Khartoum city in Wad-Madany. Another limitation was lacking data from a previous study on metastatic bone disease in prostate cancer regarding the common vertebral metastatic sites and how several distant

metastases correlate with durations of cancer and other metastatic patterns.

Conclusion

The bulk of prostatic metastasis tumors found in the vertebrae and pelvis can also be atypical metastasis, and any prostatic cancer patient should get a screening scan that assists with the preparation of treatment. Also, signs indicating harmful effects should be closely investigated and handled as a matter of priority, close observation, and prompt intervention should also be advised.

Hypothesis

Knowing of the most favorable bony sites of bone metastasis in patients with prostate cancer help in early detection of bone metastasis and prevent the impact of the skeletal complications in the quality of life

Abbreviation

BM; bone metastasis, PC; prostate cancer, SREs; Skeletal related events.

Author Declaration

We confirm that the manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed.

Consent for publication

Not applicable.

Ethical approval and consent to publish

Obtained from the federal ministry of health (FMOH), Khartoum, Sudan.

Competing of interest

No potential Competing of interest relevant to this article was reported.

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Availability of data and materials

All the data used in the study are available from the first and corresponding author on reasonable request.

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Author's contribution

MA: Project development, Data collection, Manuscript writing.

AG: Data collection, Manuscript writing.

NM: Data collection, Manuscript writing.

WM: Data analysis, Manuscript writing.

All authors have read and approved the manuscript in this form.

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